

AMENDMENTS TO THE CLAIMS:

Please replace the claims with the claims provided in the listing below wherein status, amendments, additions and cancellations are indicated.

1. (Currently amended) A three-dimensional image processing apparatus for creating a shadow image on ~~[[the]]~~ an outer surface of a 3D model using a shadow model formed by a plurality of polygons, comprising:

shadow model storage means for storing at least coordinates of vertices of the shadow model;

polygon sorting means for sorting the polygons forming the shadow model into front-facing polygons facing in directions toward a viewpoint of a virtual camera and back-facing polygons facing in directions opposite from the viewpoint of the virtual camera;

model image creating means for creating an image by applying rendering to a polygon model except the shadow model;

model image storage means for storing the image created by the model image creating means while relating frame color data, which are color data of pixels, to Z-values, which are distances to the polygons corresponding to the respective pixels, from the viewpoint of the virtual camera in a simulated three-dimensional space; and

shadow creating means for creating the shadow image in pixels which are pixels corresponding to the front-facing polygons by changing the frame color data

of the pixels stored in the model image storage means for shadow creating pixels which are:

a first set of pixels corresponding to the front-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels, and

excluding a second set of pixels corresponding to the back-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels;

said shadow creating means including means for performing an operation on said frame color data of first set of pixels which is either one of addition and subtraction of a predetermined value thereby creating modified frame color data, and for performing an additional operation on said modified frame color data of said second set of pixels which is an opposite operation of said one of addition and subtraction using said predetermined value, whereby said operation alters initial frame color data values of said first set of pixels as indicative of being the shadow creating pixels, and said second set of pixels is effectively excluded as said shadow creating pixels by a cancellation of said first operation by performance of said additional operation equal and opposite in value thereto.

2. (Original) A three-dimensional image processing apparatus according to claim 1, wherein the shadow model storage means stores normal vectors of the respective polygons forming the shadow model, and the polygon sorting means sorts the respective polygon forming the shadow model into the front-facing polygons and the back-facing polygons based on whether an inner product of the normal vector of each polygon and a camera viewing vector representing a viewing direction of the virtual camera is a positive or negative value.

3. (Canceled)

4. (Currently amended) A three-dimensional image processing apparatus according to claim 1, wherein the shadow creating means subtracts [[a]] the predetermined value from the modified frame color data of the shadow creating pixels which are stored in the model image storage means.

5. (Previously presented) A three-dimensional image processing apparatus according to claim 1, wherein the shadow creating means multiplies the frame color data of the shadow creating pixels which are stored in the model image storage means by a predetermined value.

6. (Currently amended) A three-dimensional image processing apparatus according to claim 1, wherein the shadow model storage means stores a single color data of the shadow model and the shadow creating means subtracts the color data of the shadow model from the modified frame color data of the shadow creating pixels which are stored in the model image storage means.

7. (Original) A three-dimensional image processing apparatus according to claim 1, wherein the 3D model is a character movable in a simulated three-dimensional space.

8. (Currently amended) A readable storage medium storing a three-dimensional image processing program for creating a shadow image on the outer surface of a 3D model using a shadow model formed by a plurality of polygons, the program comprising the steps of:

storing at least coordinates of vertices of the shadow model;

sorting the polygons forming the shadow model into front-facing polygons facing in directions toward a viewpoint of a virtual camera and back-facing polygons facing in directions opposite from the viewpoint of the virtual camera;

creating an image by applying rendering to a polygon model except the shadow model;

storing the image created by the model image creating means while relating frame color data, which are color data of pixels, to Z-values, which are distances to the polygons corresponding to the respective pixels, from the viewpoint of the virtual camera in a simulated three-dimensional space; and

creating the shadow images in pixels which are pixels corresponding to the front-facing polygons by changing the frame color data of the pixels stored in the model image storage means for shadow creating pixels which are:

a first set of pixels corresponding to the front-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels, and

excluding a second set of pixels corresponding to the back-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels;

said step of creating including performing an operation on said frame color data of first set of pixels which is either one of addition and subtraction of a predetermined value thereby creating modified frame color data, and performing an additional operation on said modified frame color data of said second set of pixels which is an opposite operation of said one of addition and subtraction using said predetermined value, whereby said operation alters initial frame color data values of

said first set of pixels as indicative of being the shadow creating pixels, and said second set of pixels is effectively excluded as said shadow creating pixels by a cancellation of said first operation by performance of said additional operation equal and opposite in value thereto.

9. (Original) A readable storage medium according to claim 8, wherein normal vectors of the respective polygons forming the shadow model are stored, and the polygon sorting processing is performed to sort the respective polygon forming the shadow model into the front-facing polygons and the back-facing polygons based on whether an inner product of the normal vector of each polygon and a camera viewing vector representing a viewing direction of the virtual camera is a positive or negative value.

10. (Canceled)

11. (Currently amended) A readable storage medium according to claim 8, wherein ~~[[a]]~~ the predetermined value is subtracted from the modified frame color data of the shadow creating pixels which are stored in the model image storage means during the shadow image creating processing.

12. (Previously presented) A readable storage medium according to claim 8, wherein the frame color data of the shadow creating pixels which are stored in the model image storage means are multiplied by a predetermined value during the shadow image creating processing.

13. (Currently amended) A readable storage medium according to claim 8, wherein a single color data of the shadow model is stored, and the color data of the shadow model is subtracted from the modified frame color data of the shadow creating pixels which are stored in the model image storage means during the shadow image creating processing.

14. (Original) A readable storage medium according to claim 8, wherein the 3D model is a character movable in a simulated three-dimensional space.

15. (Currently amended) A three-dimensional image processing method for creating a shadow image on the outer surface of a 3D model using a shadow model formed by a plurality of polygons, the method comprising the steps of:

storing at least coordinates of vertices of the shadow model;

sorting the polygons forming the shadow model into front-facing polygons facing in directions toward a viewpoint of a virtual camera and back-facing polygons facing in directions opposite from the viewpoint of the virtual camera;

creating an image by applying rendering to a polygon model except the shadow model;

storing the image created by the model image creating means while relating frame color data, which are color data of pixels, to Z-values, which are distances to the polygons corresponding to the respective pixels, from the viewpoint of the virtual camera in a simulated three-dimensional space; and

creating the shadow images in pixels which are pixels corresponding to the front-facing polygons by changing the frame color data of the pixels stored in the model image storage means for shadow creating pixels which are:

a first set of pixels corresponding to the front-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels, and

excluding a second set of pixels corresponding to the back-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels;

said step of creating including performing an operation on said frame color data of first set of pixels which is either one of addition and subtraction of a predetermined value thereby creating modified frame color data, and performing an additional operation on said modified frame color data of said second set of pixels

which is an opposite operation of said one of addition and subtraction using said predetermined value, whereby said operation alters initial frame color data values of said first set of pixels as indicative of being the shadow creating pixels, and said second set of pixels is effectively excluded as said shadow creating pixels by a cancellation of said first operation by performance of said additional operation equal and opposite in value thereto.

16. (Currently amended) A video game system, comprising:

a three-dimensional image processing apparatus for creating a shadow image on the outer surface of a 3D model using a shadow model formed by a plurality of polygons, including:

shadow model storage means for storing at least coordinates of vertices of the shadow model;

polygon sorting means for sorting the polygons forming the shadow model into front-facing polygons facing in directions toward a viewpoint of a virtual camera and back-facing polygons facing in directions opposite from the viewpoint of the virtual camera;

model image creating means for creating an image by applying rendering to a polygon model except the shadow model;

model image storage means for storing the image created by the model image creating means while relating frame color data, which are color

data of pixels, to Z-values, which are distances to the polygons corresponding to the respective pixels, from the viewpoint of the virtual camera in a simulated three-dimensional space; and

shadow image creating means for creating the shadow image in pixels which are pixels corresponding to the front-facing polygons by changing the frame color data of the pixels stored in the model image storage means for shadow creating pixels which are:

a first set of pixels corresponding to the front-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels, and

excluding a second set of pixels corresponding to the back-facing polygons of the shadow model whose distances from the viewpoint of the virtual camera in the simulated three-dimensional space are smaller than the Z-values of the corresponding pixels;

said shadow image creating means including means for performing an operation on said frame color data of first set of pixels which is either one of addition and subtraction of a predetermined value thereby creating modified frame color data, and for performing an additional operation on said modified frame color data of said second set of pixels which is an opposite operation of said one of addition and subtraction using said predetermined

value, whereby said operation alters initial frame color data values of said first set of pixels as indicative of being the shadow creating pixels, and said second set of pixels is effectively excluded as said shadow creating pixels by a cancellation of said first operation by performance of said additional operation equal and opposite in value thereto;

image display means for displaying an image including a shadow image on the outer surface of a 3D model;

program storage means for storing a game program data; and

externally operable operation means;

wherein the three-dimensional image processing apparatus displays images on the image display means in accordance with the game program data.